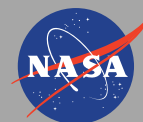


# No Tow Trucks Beyond Mars

D. Rosing  
S. Tucker  
R. Morgan  
K. Boykins



**Jet Propulsion Laboratory**  
California Institute of Technology



# Thank You

- Welcome to the 4<sup>th</sup> annual JPL panel at WonderCon
- Everyone here on this panel has worked on amazing things that made amazing discoveries. This is our way of saying “thank you” to you, the taxpayers, for letting us be nerds and do things that no one else in the world has done. We could not have done it without your support (via congressional funding)
- We want to tell you stories of things or events that you just don’t hear about, even on Wiki. And we want to have fun sharing, so please don’t expect any finger pointing or dirty laundry.
- Rules
  - ITAR. We are bound by International Traffic in Arms Regulations. So if I interrupt Tracy or Shonte it’s not because there’s a conspiracy or anything, but we’re limited to what we can say in public on how we fix problems on the spacecraft.
  - Please let the speaker finish their story, we can answer a few questions, then go off to the next story. At the end we can answer more questions.
  - Have fun!

# Who are these people?

- **David Rosing (40 years)**
  - BS Univ of Colorado, MS Stanford, Aerospace Engineering
  - Galileo (Jupiter), Magellan (Venus), IRAS (all-sky IR survey), Lambda-Point Experiment (Shuttle), VIMS instrument (Cassini-Saturn), Opto-Mechanical engineering group supervisor, Mars aircraft & instruments, Mars Sample Return future mission concepts
- **Shonte Tucker (26 years)**
  - BS UC San Diego, MS North Carolina A&T, Mechanical Engineering and Heat transfer
  - Systems Engineer working at NASA's Jet Propulsion Laboratory; worked numerous orbiter and landed missions in phases ranging from conceptual studies to flight operations. Currently the Payload Verification and Validation Lead for the Mars 2020 rover mission.
- **Rhonda Morgan**
  - Planetary geologist specializing in alien deserts and extraterrestrial volcanoes. Currently Deputy Project Scientist of the Mars Odyssey mission.
- **Kobie Boykins (22 years)**
  - BS Mechanical Engineering, Rensselaer Polytechnic Institute
  - MARS Pathfinder, Mars Exploration Rovers, Mars Science Lab, Mars 2020 ECOSTRESS, OCO-3, Jason-2, Jason-3, SWOT, NISAR, Grace-FO, Potential Europa Clipper and Lander
  - Member of Division Staff, Mechanical Engineering, Section Manager, Group Supervisor

# **To Boldly Go Where There Are No Gas Stations**

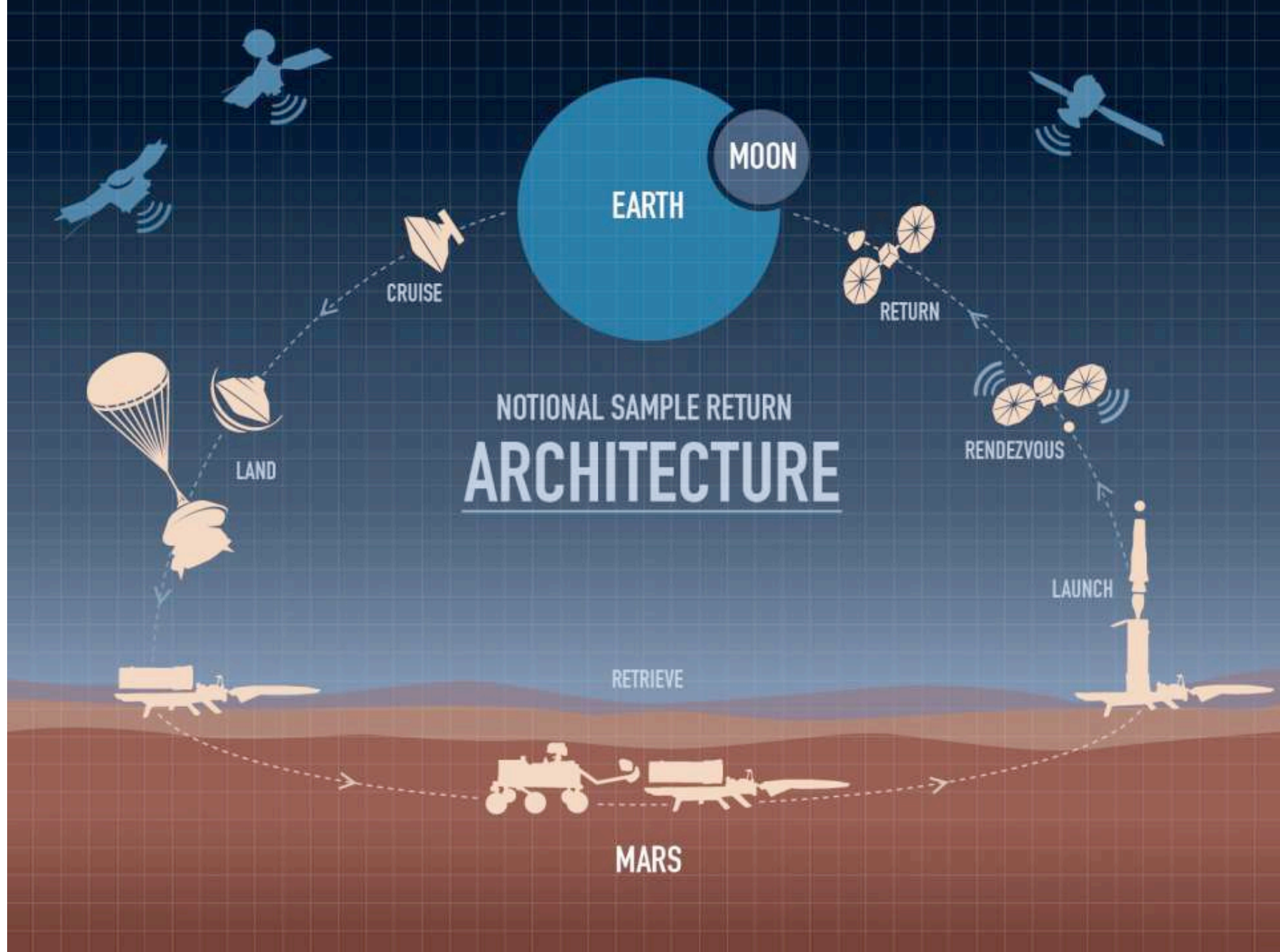
- There is no auto club at Mars, Jupiter, Saturn
- One way light time can be 30 minutes to a few hours
- The slightest mistake or miscalculation can ruin your day and the mission



## Questions to the crew:

- 1) The most fun project you had at JPL
- 2) the worst moment you had
- 3) the best moment you had
- 4) Most challenging problem you overcame (in a way that is ITAR correct)
- 5) Did you ever have “Captain Kirk” moment?

” I’ve cheated death. I tricked my way out of death ...and patted myself on the back for my ingenuity. . . .” (TWOK, 1982)



# DECADAL SURVEY MSR CONCEPTS

## Sample Caching Rover



- MSL-heritage Skycrane EDL
- MAX-C Rover (solar powered)
  - Sample Caching System
  - Instrument suite for sample selection/context
  - 2 integrated caches, each w/ 19 sample tubes

### Key Technologies

- Sample Caching System
- Terrain Relative Navigation

## Sample Return Lander



- MSL-heritage Skycrane EDL
- Pallet Lander
  - Fetch Rover (157 kg)
  - Mars Ascent Vehicle (2-stage Solid-Solid)
  - 17-cm OS

### Key Technologies

- Mars Ascent Vehicle
- Fast Fetch Rover

## Sample Return Orbiter

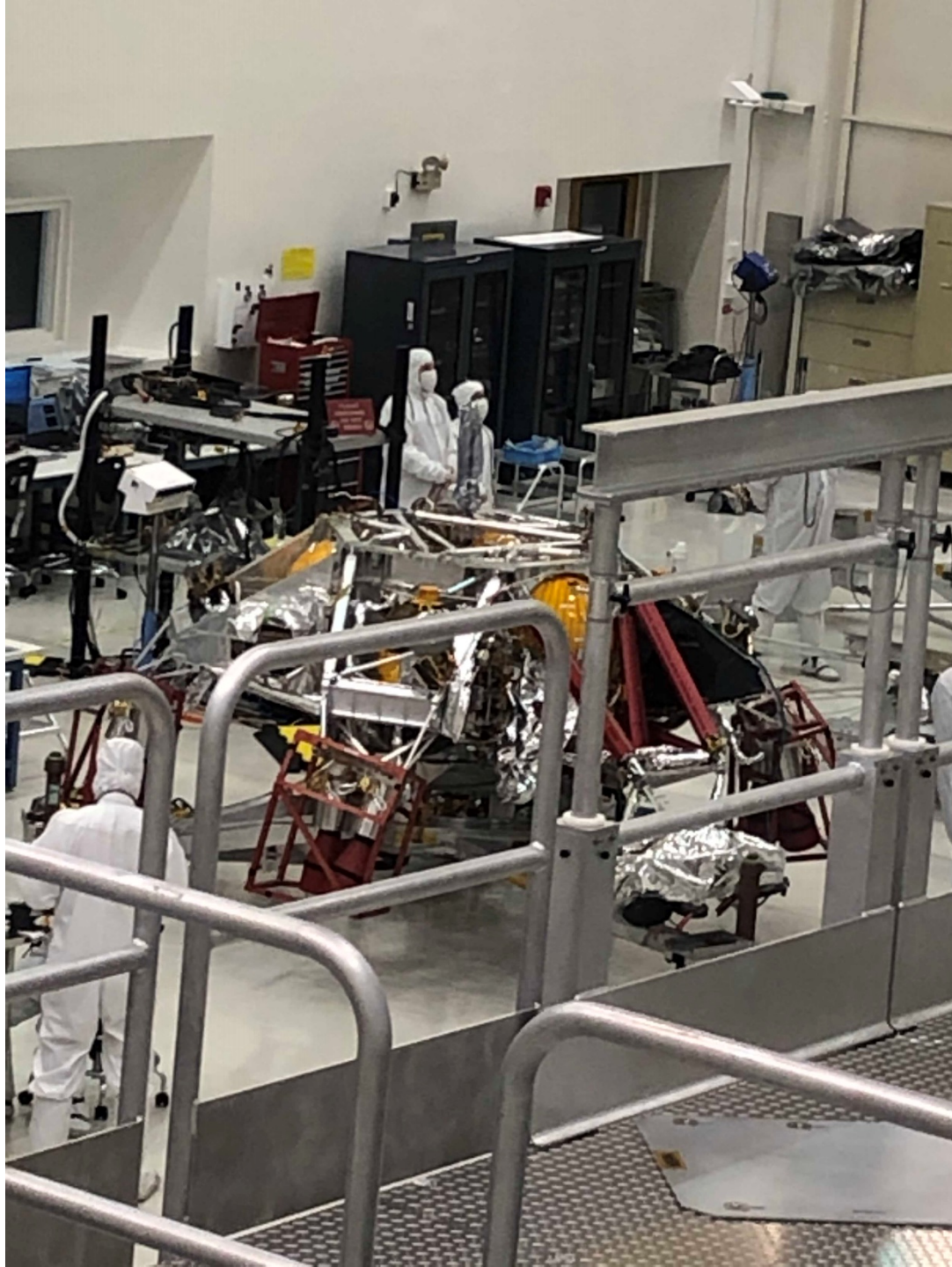


- Round-trip Orbiter (Chemical Propulsion)
  - MOI, Aerobrake
  - OS Rendezvous & Capture
  - Earth Return
  - Earth Entry Vehicle
- Mars Returned Sample Handling

### Key Technologies

- OS Rendezvous and Capture
- Back Planetary Protection









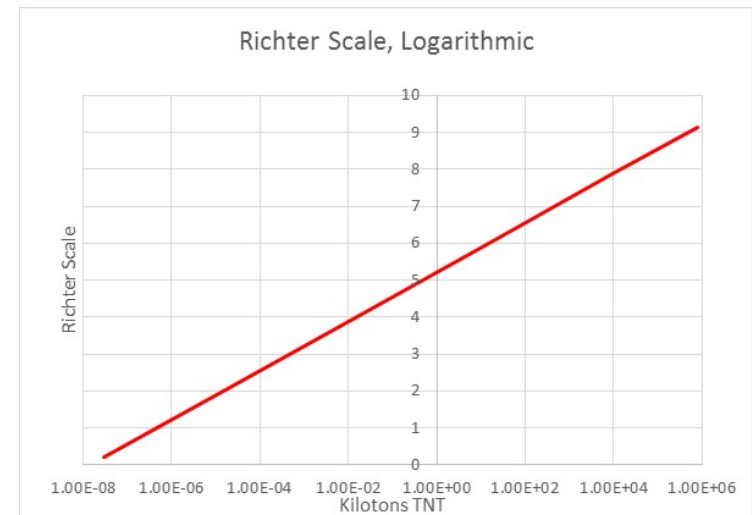
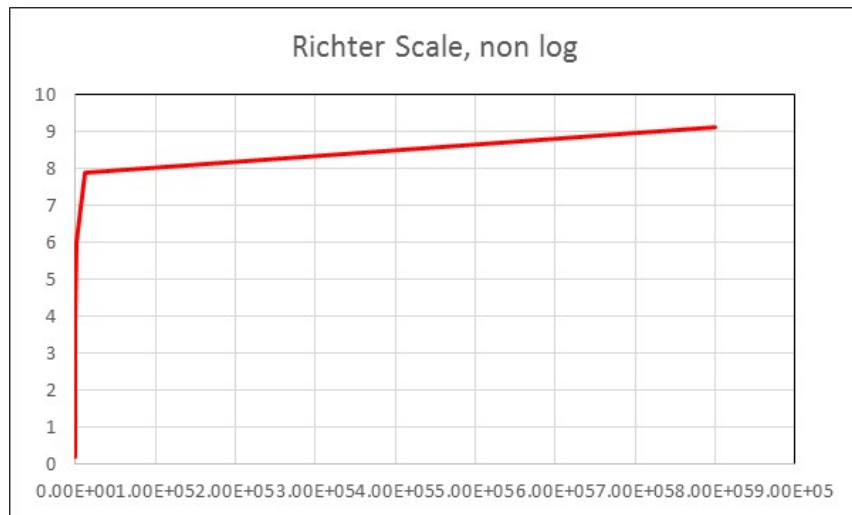






# Movies: “Real” vs. “Reel”

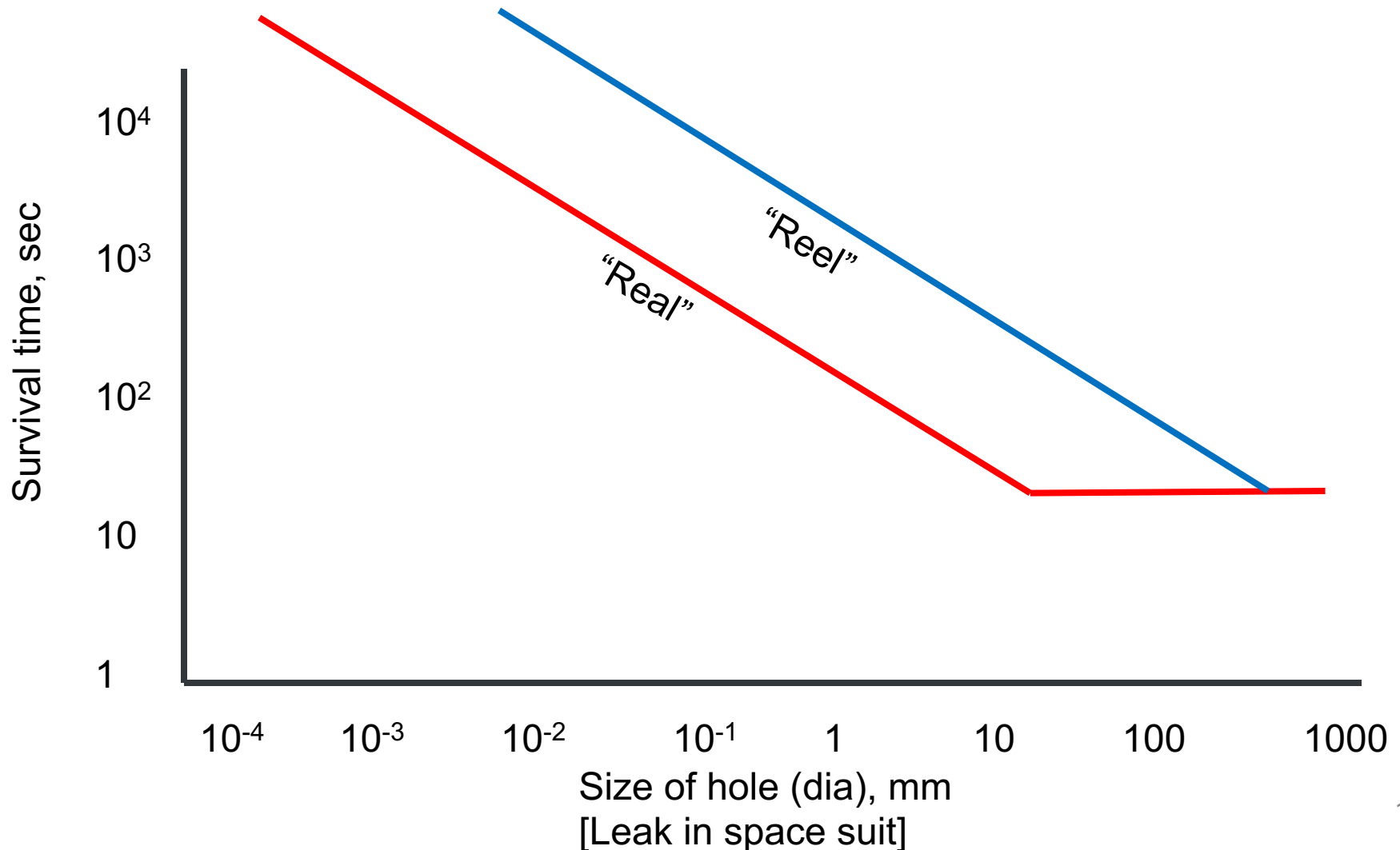
- Logarithmic plot: Example Richter scale



kTon TNT	Richter Scale
3.00E-08	0.2
2.10E-05	2.1
0.011	3.91
15	6
10700	7.9
800000	9.15

# Movies: “Real” vs. “Reel”

- Log-log chart, “Survival time” vs. “Severity of failure”

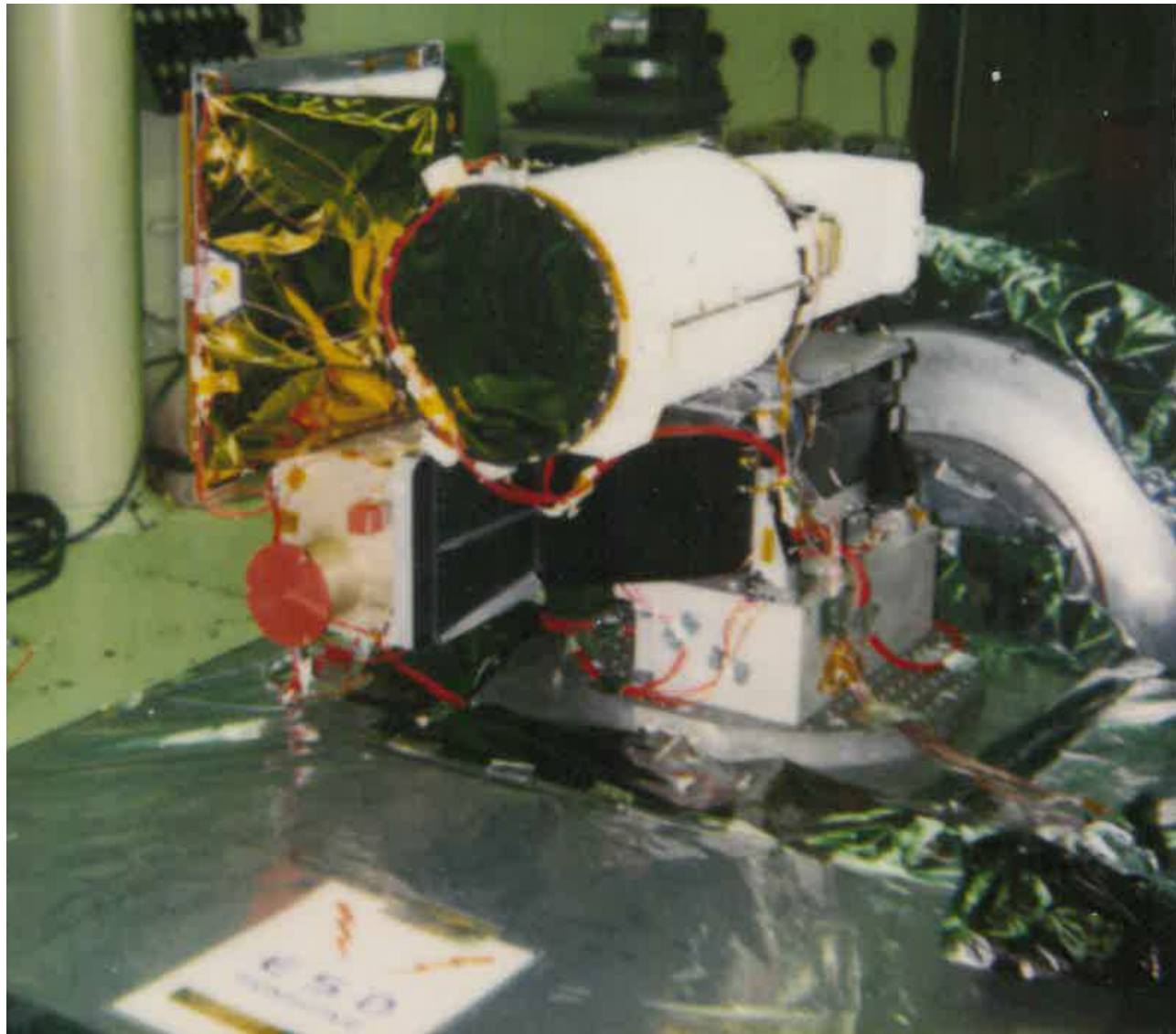


# More questions?

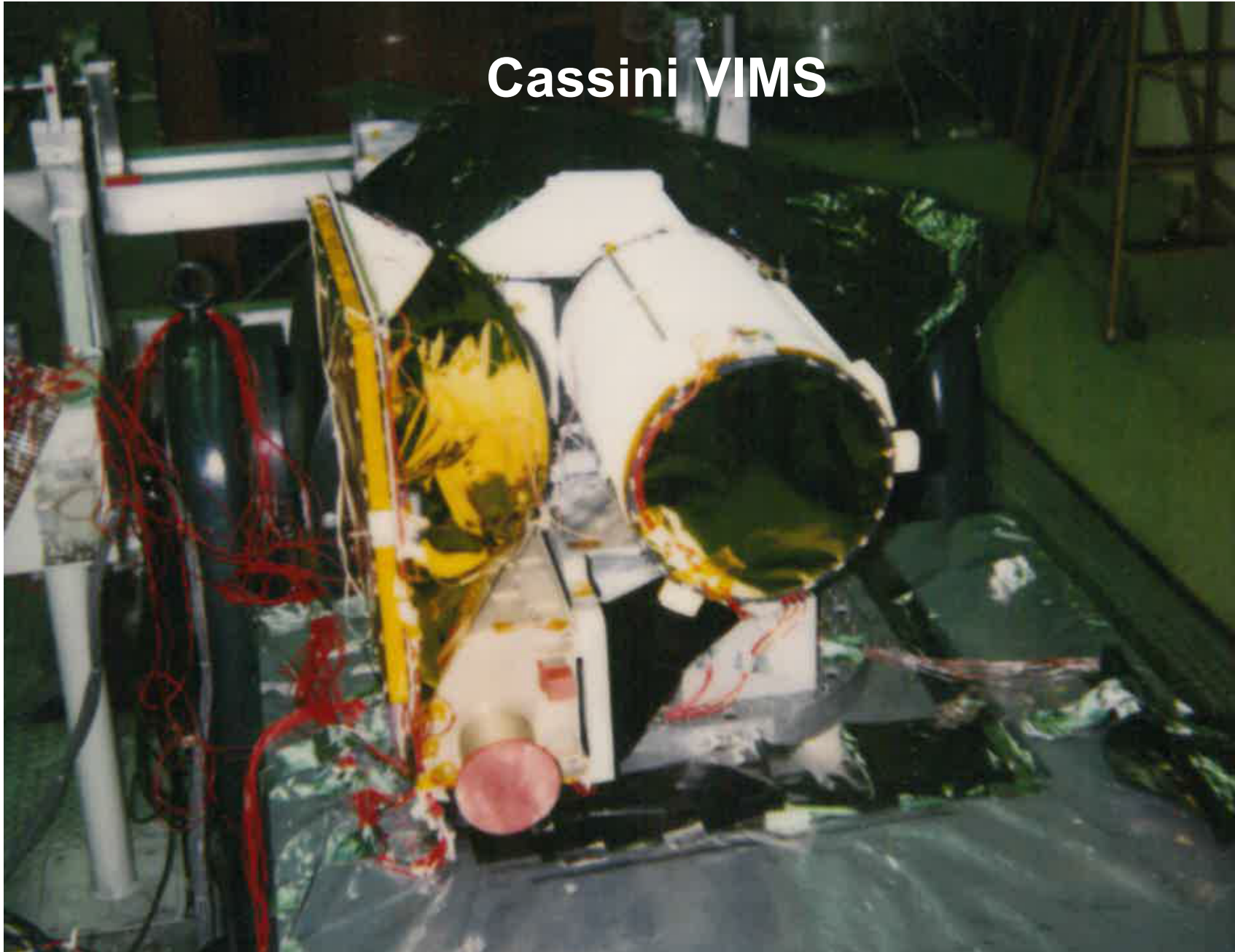
- For the remainder of WonderCon I'll be at Small Press booth 53
  - (Boston Metaphysical Society Comic)
  - Come on by to chat Space or Kickstarters



# Cassini VIMS



# Cassini VIMS

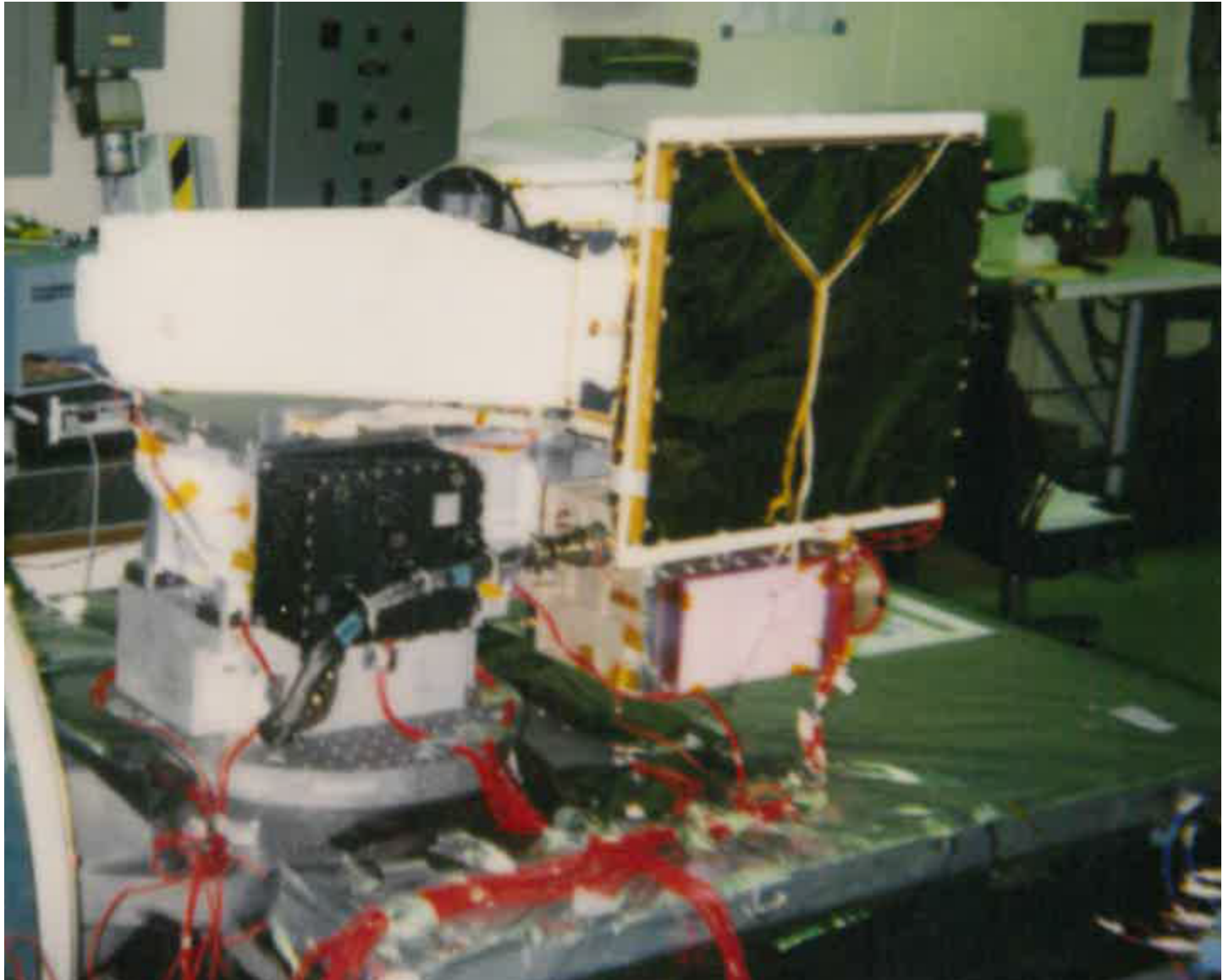


# Cassini VIMS





# Cassini VIMS

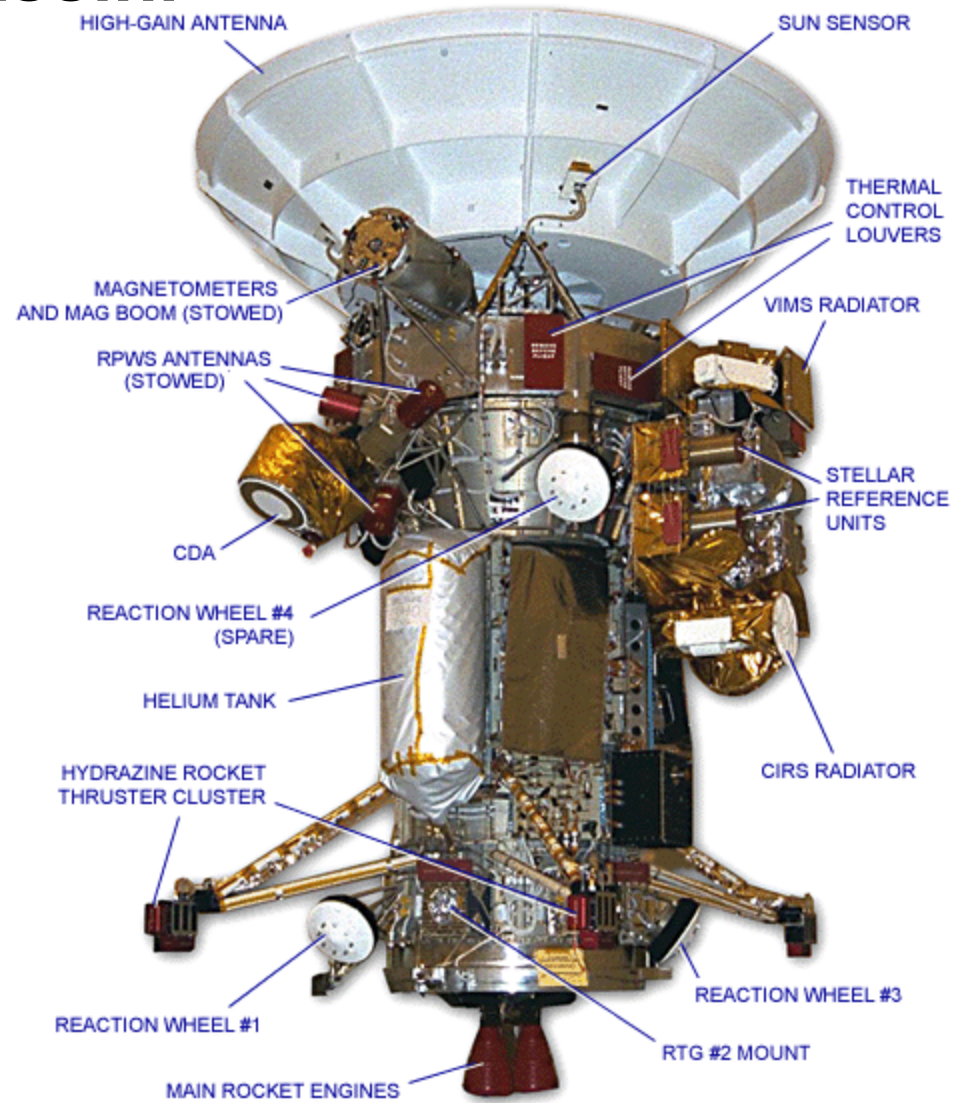
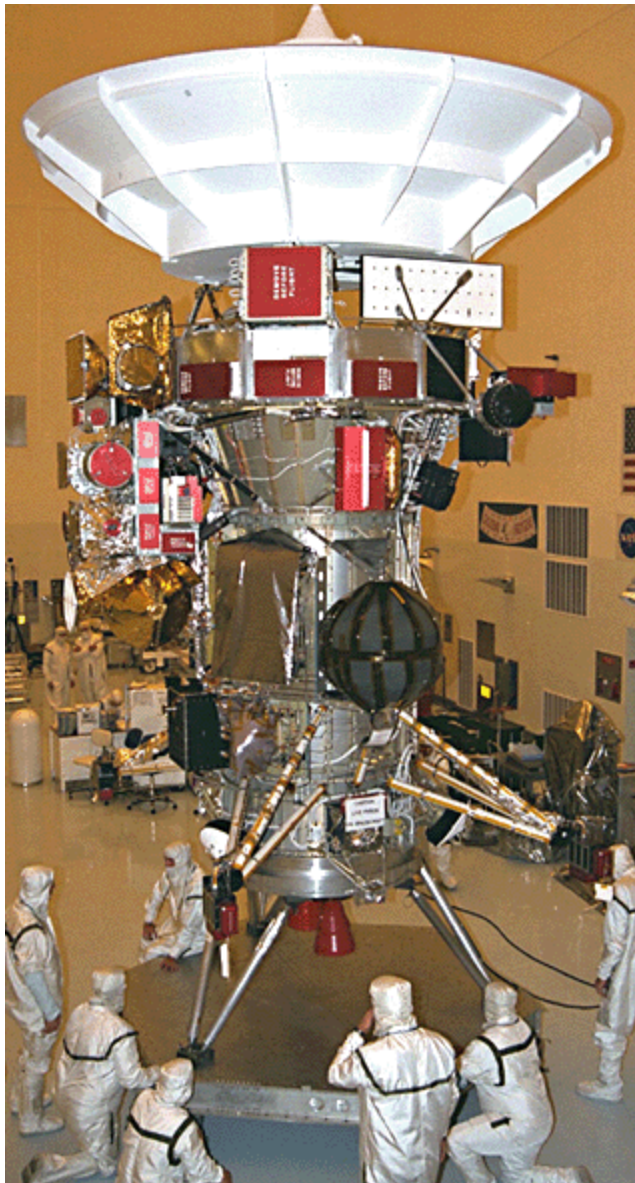


# Cassini





# Cassini



# Cassini





# Shonte Tucker

Senior Thermal Engineer  
Jet Propulsion Laboratory  
May 16, 2014



*The opinions expressed herein are my own opinions and do not necessarily reflect the opinions of the California Institute of Technology or the Jet Propulsion Laboratory*



# Shonte Tucker *Alias* Kapton Girl



## What is Kapton?

Kapton® is a polyimide film developed by DuPont™ in the late 1960s that remains stable across a wide range of temperatures, from  $-452^{\circ}\text{F}$  to  $752^{\circ}\text{F}$  ( $-269^{\circ}\text{C}$  to  $+400^{\circ}\text{C}$  /  $4\text{K}$  to  $673\text{K}$ ).

*Kapton in tape form is generally referred to as*

## Duct Tape for Space

### Kapton® Tape



Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement by the United States Government or the Jet Propulsion Laboratory, California Institute of Technology.

## Some Tools of the Trade

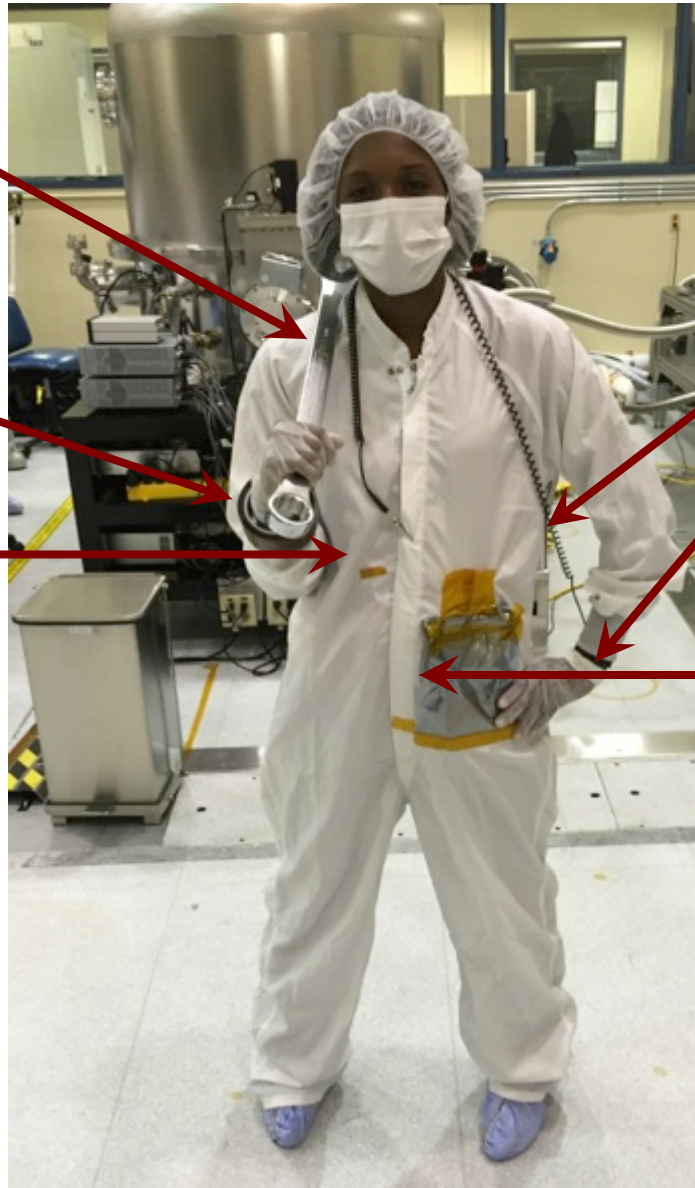
**1 5/8" Wrench**  
for large nuts/bolts

**Kapton® Tape**  
(2" Roll)

**Kapton® Tape**  
*randomly attached to  
cleanroom (bunny)  
suit*

**Anti Static Wrist  
Strap and Cord**

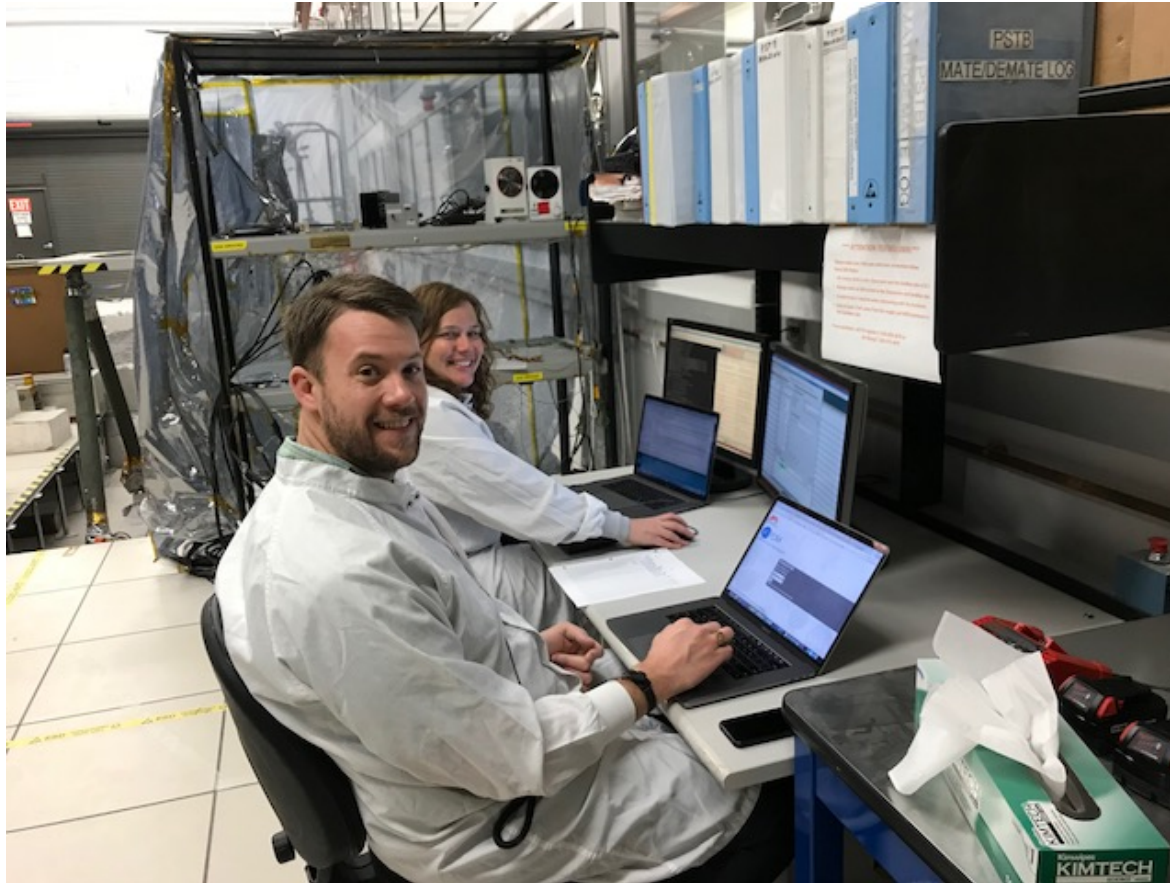
**Anti Static Bag**



# Testbeds

- Flight Software Testbeds
- Vehicle System Testbeds

# Mars 2020 Flight System Testbed



Zach Bailey (*Mastcam-Z Instrument Engineer*) and Jennifer Rodriguez (*Testbed Engineer*)



# Mars Science Laboratory (MSL) Curiosity Rover Vehicle System Testbed



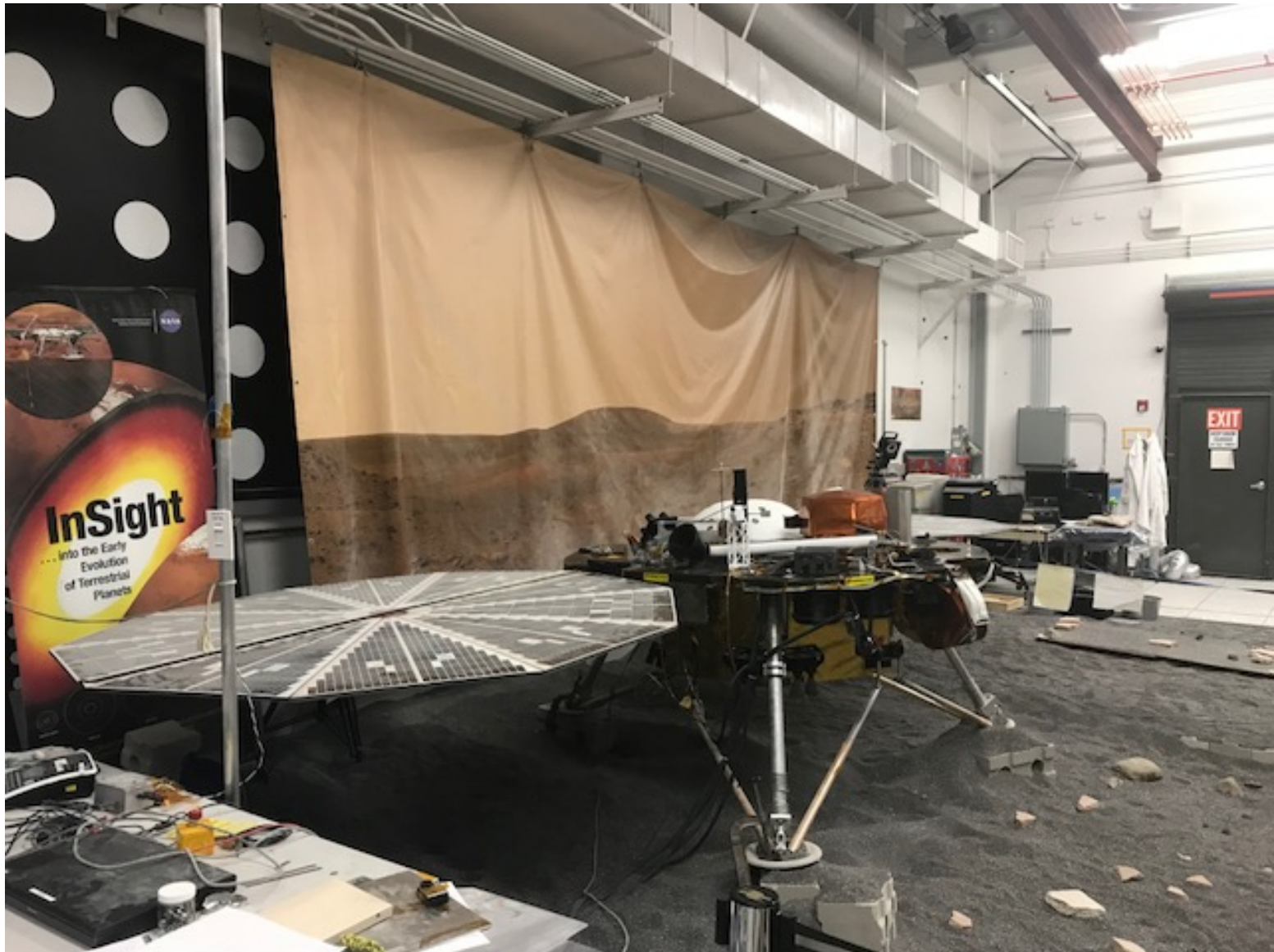


# MSL Curiosity Rover Vehicle System Testbed





# InSight System Testbed



# Mars Rover Family

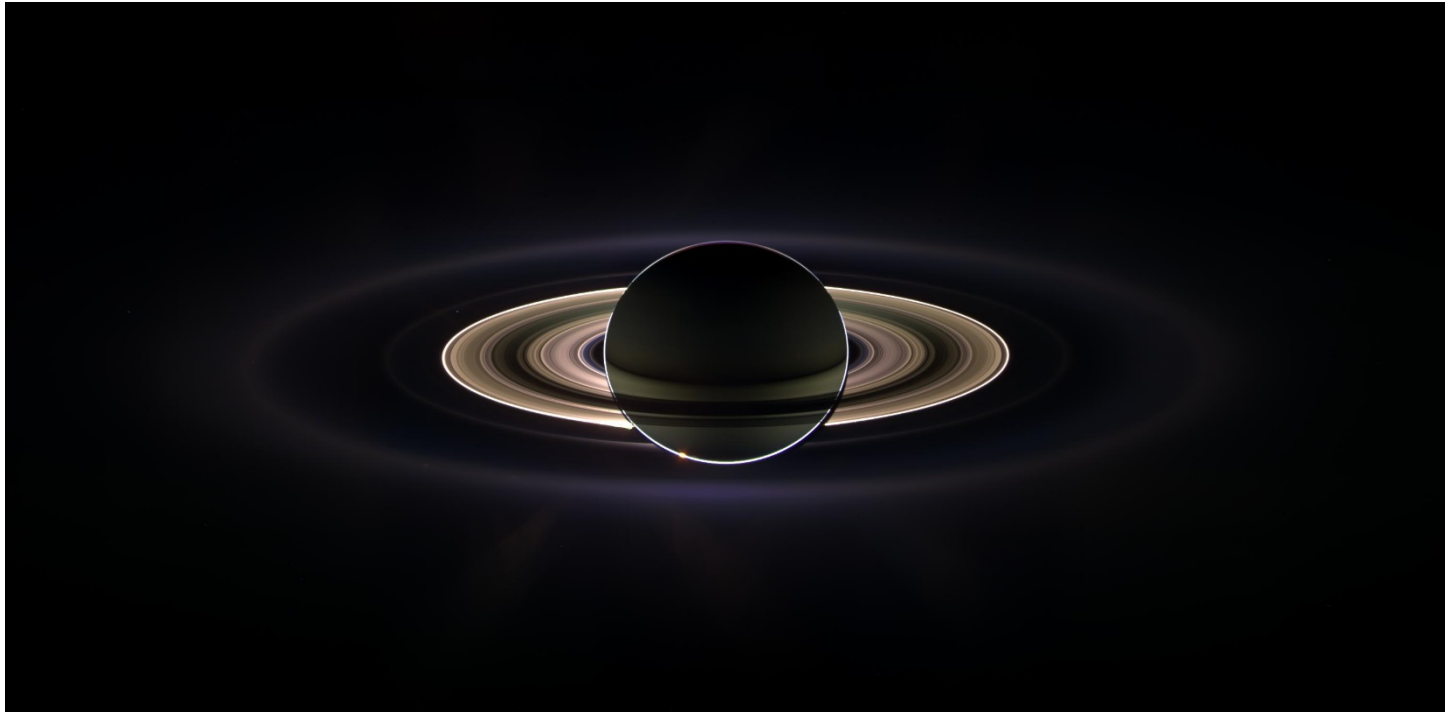


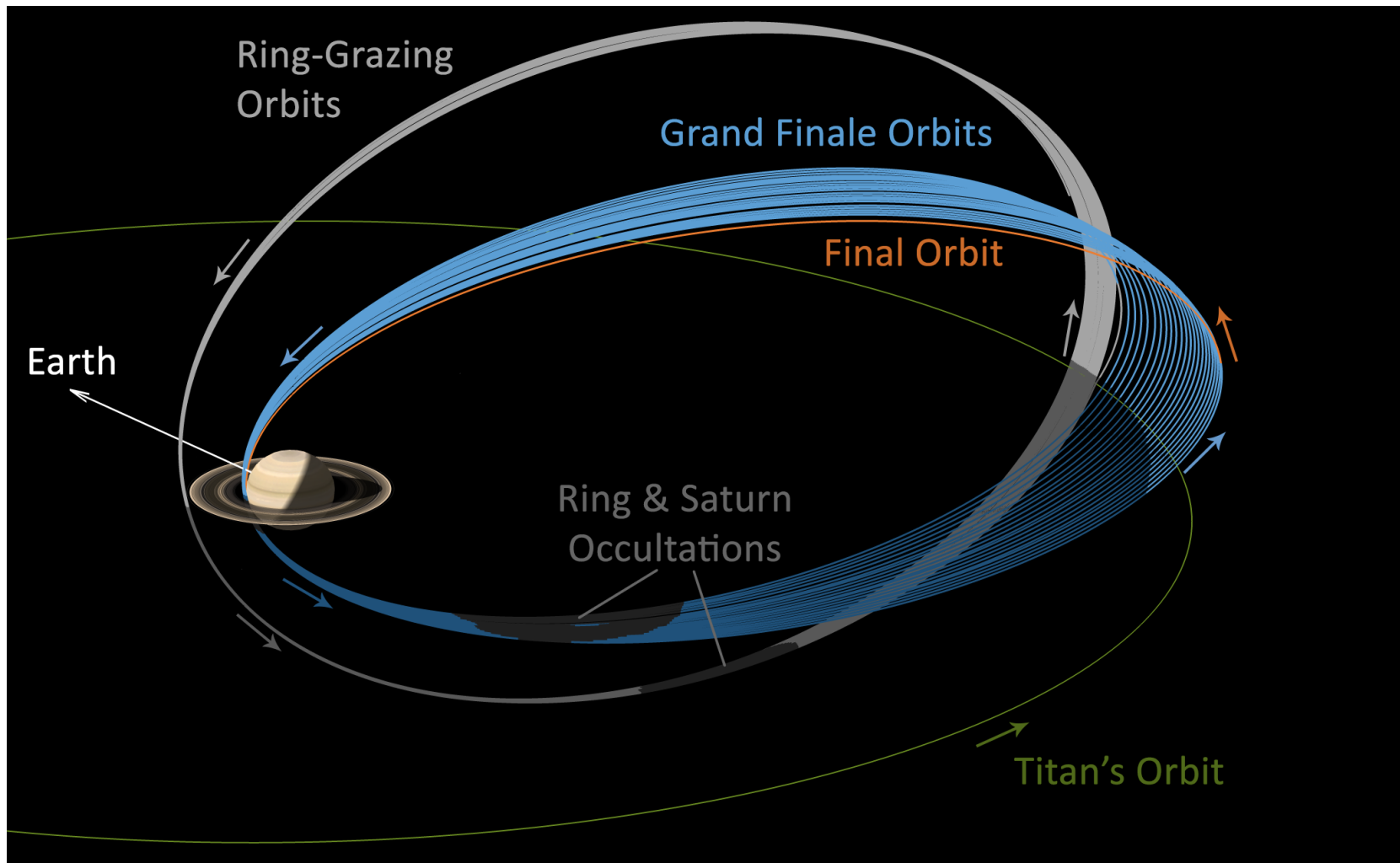






# National Geographic Cover 12/2006





The Pics from F-Ring Orbits—and Stay Tuned for Proximal Orbit Images,  
Too! 😊

